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The nitrous acid produced may act upon compounds of iron, aluminum, potassium, sodium, or magnesium which occur in soils, or it may act upon tricalcium phosphate, calcium silicate, or calcium carbonate, if present. For this reason, it has been recommended that the ideal practise to obtain the greatest solubility of the raw rock phosphate is to turn it under in intimate contact with organic matter, and, if needed, to apply ground limestone after plowing or at some other point in the crop rotation.

In Table II. are presented the actual amounts of phosphorus, calcium and nitrogen required by standard crops, and the amounts of phosphorus and calcium which would be made soluble if all the nitrogen required for the crop should be oxidized to nitrate and should act upon pure rock phosphate.

TABLE II
Nitrogen Oxidized, and Phosphorus and Calcium Made Soluble by Nitrite Bacteria
(Expressed in Milligrams)

Flask	Duration in Days	Nitrogen Oxidized	Phosphorus Made Soluble	Calcium Made Soluble
1	28	2.54	4.08	3.87
2	41	4.81	5.08	5.60
3	41	5.99	8.40
4	48	5.52	9.56	14.80
5	48	4.88	10.20	18.40
6	55	6.40	12.85	22.00
7	55	6.40	10.24	23.52
8	62	6.88	16.00	31.04
9	48	3.61	7.52	13.60
10	62	3.87	8.76	16.48
11	62	5.84	9.82	16.00
12	62	5.68	11.28	20.80
13	69	6.03	11.14	22.40
14	48	5.76	13.04	24.80
15	69	4.60	11.60	19.20
16	139	18.84	41.56	75.26

The figures show that there is possible of solution from this biochemical process about 7 times as much phosphorus as corn, wheat or oats require, and 9 times as much as timothy requires. Greater differences occur in the calcium figures, there being possible of solution phosphate as on the pure rock phosphate, but more extensive experiments with the natural rocks will be reported later.

14 times that required for corn, 18 times that required for wheat, 12 times that required for oats, and 8 times that required for timothy.

SUMMARY

1. Nitrite bacteria make phosphorus and calcium soluble from insoluble phosphates when they oxidize or convert ammonia into nitrite.

2. The actual ratio found shows that about one pound of phosphorus and about two pounds of calcium are made soluble for each pound of nitrogen oxidized, aside from the action of the acid radicles associated with the ammonia.

3. The ratio of solubility found on the basis of nitrogen to phosphorus and calcium conforms to the following reaction:



According to this equation, 56 pounds of nitrogen liberate in soluble form 62 pounds of phosphorus and 120 pounds of calcium.

4. Neither ammonia-producing bacteria nor nitrate bacteria liberate appreciable amounts of soluble phosphorus from insoluble phosphates.

More complete details of these experiments will be published in Bulletin No. 190 of the University of Illinois Agricultural Experiment Station.

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THE AMERICAN CHEMICAL SOCIETY II

The following papers were read and discussed.

The So-called Caseinates: W. D. BANCROFT.

Action of Rennin on Caseine: W. D. BANCROFT.

The Aeration Method for Total Nitrogen Determinations: R. S. POTTER AND R. S. SNYDER.

Titrimetric Determination of Nitrite N: B. S. DAVISSON.

Determination of Ammonia by Aeration: B. S. DAVISSON.

A Study of Carbohydrates as Milk Modifiers: RUTH WHEELER.

The Relation of a Diet High in Calcium to the Calcium Content of Tissues: AMY L. DANIELS.

Report of a Survey of the Food Conditions at Sing Sing Prison: EMILY B. SEAMAN.

The Relation of Biological Chemistry to Problems of the Community: EMILY B. SEAMAN.

Washing and Cleaning: W. D. BANCROFT.

Whipped Cream, Etc.: W. D. BANCROFT.

Mayonnaise: W. D. BANCROFT.

On Soap Jelly Formation: G. H. A. CLOWES.

NaCl or other Na salts added to slightly alkaline soap solutions cause jelly formation between .2*N* and .4*N*, and precipitate at higher concentrations.

Same salts added to neutral or slightly acid soap cause opalescence at .2*N*, gradually increasing until complete precipitation occurs above .4*N*.

Degree of dispersion of negative soap particles depends on adsorbed anions derived from added alkali. Subsequently adsorbed cations cause aggregation. Larger particles with smaller charge precipitate earlier, smaller particles with larger charge coalesce later forming jelly. If at critical cation concentration particles still exhibit active Brownian movement, jelly is subsequently formed enclosing water in interspaces, otherwise precipitation occurs.

On Filtration of Blood Plasma: G. H. A. CLOWES AND F. WEST.

In 1913, writers confirmed Cramer's observation that citrated plasmas may be obtained by filtration through Berkefeld bougies which coagulate with thrombin but not with calcium alone. Bougie removes lipoids. Addition of sterilized brain lipid one part in 50,000 causes coagulation with calcium. Added lipid may be entirely removed by second filtration prior to addition of calcium. Resulting filtrate does not clot with calcium.

Cleaned and sterilized bougies often contain sufficient calcium to cause local coagulation of plasma with consequent production of thrombin which passes into the filtrate, complicating subsequent experiments. This may afford explanation of Goddard's results.

Mechanism of Blood Coagulation: G. H. A. CLOWES.

Dispersion of negatively charged fibrinogen and lipid particles is normally maintained by adsorbed anions. Analogous, antagonistic, electrolyte effects in emulsions, jellies and blood coagulation suggest probability that Ca by adsorption first lowers charge and promotes deposition of lipid film on fibrinogen particles, and subsequently Ca soaps, being freely dispersed in lipoids involved, cause surface tension changes and transposition of phase relations analogous to those ob-

served in emulsions, the previously dispersed fibrinogen becoming the continuous fibrin clot in which water is more or less dispersed. Presumably thrombin, by local adsorption, promotes hydrolysis, liberates acid groups, lowers negative charge, raises surface tension, and so promotes aggregation.

Investigation of the Kjeldahl Method for Determining Nitrogen. A New Aeration Apparatus: I. K. PHELPS AND H. W. DAUDT.

Folin's method for determining ammonia is adapted to the Kjeldahl method. All of the operations, including the measurement and addition of the sodium hydroxide solution, the passing of air through the resulting alkaline solution and the absorption of the ammonia in standard acid are carried on by means of air pressure or suction. The advantages over the more commonly used distillation method are discussed.

Remarks on the Physical and Biological Chemistry of Fat: MARTIN H. FISCHER.

The general principles governing the production and the destruction of water-in-oil and oil-in-water emulsions and their general properties are discussed. Protoplasm represents ordinarily a fine oil-in-water emulsion. The characteristic feature of "fatty degeneration" is a coalescence of these fine droplets into coarser ones, the conditions producing such being identical with those producing the coarsening of an oil-in-water emulsion. Adipose tissue, butter formation and the formation of fatty secretions consists in the conversion of the oil-in-water type of emulsion into the water-in-oil type. The experimental facts underlying these conclusions are illustrated.

Studies Upon the Effects of Acids: ARTHUR D. HIRSCHFELDER.

Repetition of the experiments of Hofmeister and Martin Fischer on the swelling of fibrin in mixtures of acids and neutral salts, show that the solutions in which swelling seems to be inhibited (except the sulphates) are much poorer in hydrogen ions than the corresponding ones in which this is only slightly the case; and that when these are all brought to the same hydrogen ion concentration the amount of swelling is the same in all the solutions except those containing sulphates which markedly inhibit. Varying either the chlorine ions or the other ions to bring about the acidification gives the same results. Adding a little dilute H₂SO₄ or Na₂SO₄ to mixtures already swollen under the influence of other acids causes marked shrinking.

However, injection of phenolsulphonphthalein,

phenolphthalein, rosolic acid and para nitrophenol into conjunctivæ of rabbits rendered markedly edematous with mustard oil, shows the reaction of the edematous tissue to be slightly on the alkaline side of neutral, very close to the reaction of the animal's blood. Excised bits of lid and conjunctivæ give no such edema in Ringer's solution acidified to various degrees.

These facts are not in harmony with the acid theory of edema.

Brain Lipoid as a Hemostatic: ARTHUR D. HIRSCHFELDER.

Kephalin has been shown to be identical with thromboplastin. An active preparation can be made from an ether extract of ox brain. The residue of such an extract or a weak emulsion of it in salt solution, when placed on an oozing surface of tissue stops bleeding very quickly and gives a very clean field for operation.

Hemorrhage from bone, kidney, muscle and connective tissue, prostate and other glands, are easily controlled by this means. Hemorrhage from cut artery can not be controlled instantly because the force of the blood pressure pushes away the clot as fast as it can be formed. In a pitted wound, however, such as occurs in warfare or when the femoral artery is cut through in Scarpa's triangle, and the pitted wound fills with blood, application of the lipoid causes it to stop spontaneously because a thick enough layer of fibrin can be formed.

The solution of lipoid residue keeps several months. It is rendered sterile by its preparation, and is very useful for practical surgery as well as for laboratory operations.

The Rôle of Cystine in the Maintenance of Nitrogenous Equilibrium in Dogs on a Low Protein Diet: HOWARD B. LEWIS.

The Excretion of Uric Acid After Ingestion of Sodium Benzoate in Man: HOWARD B. LEWIS AND WALTER G. KARR.

During the first four hours following ingestion of large doses (7-8 gm.) of sodium benzoate by healthy men, the periods during which maximal elimination of hippuric acid was taking place, the uric acid elimination was decreased from 50 to 70 per cent. as compared with the elimination in corresponding periods of control days. No compensatory increase in uric acid excretion occurred in later periods. Creatinine elimination was not affected. The ingestion of amounts of sodium hippurate equivalent to the benzoate fed in the previous experiments had no influence on uric acid excretion.

A Comparative Study of the Urea Content of the Blood and Tissues of Some Vertebrates: WALTER G. KARR AND HOWARD B. LEWIS.

The urea concentration of the tissues of normal guinea-pigs is the same as that of the blood (20-30 mg. per 100 c.c.) with the exception of the kidneys, in which the presence of urine results in high figures. The urea content of the blood of fasting guinea-pigs or of pigs on an insufficient diet may rise to 6-7 times the normal figure with a less marked rise in the concentration of urea of the tissues in most cases. The urea concentration of the blood and tissues of hens is low (5-10 mg. per 100 c.c.), the kidneys having no higher concentration of urea than any other tissue. Injection of alanine into hens causes no rise in the urea content of blood or tissues.

On the Esterification of Amino Acids: H. A. SHONLE AND H. H. MITCHELL.

The following method of determining the rate and extent of esterification of the amino acids of proteins is reported. The protein is hydrolyzed and the hydrolysate prepared for esterification (Phelps-Tillotson) as usual, except that decolorization is effected by making alkaline with $\text{Ba}(\text{OH})_2$ before removal of the water, filtration, and subsequent removal of the barium. During the esterification small samples are removed and diluted with 95 per cent. alcohol to a definite volume. In one aliquot the total acidity is determined by a Sørensen formol titration; in another, the mineral acidity by a Cl determination (Volhard). The remainder is completely saponified by boiling with HCl, made up to volume, and the above determinations repeated. From these data the per cent. of unesterified amino acidity may be calculated.

The Preparation of a Synthetic Milk for Use in Studying Infant Metabolism: A. W. BOSWORTH.

The method in brief consists of four steps as follows:

1. The preparation of isolated food materials for use in making the synthetic milk.
2. The recombining of these materials to give a mixture of the desired percentage composition.
3. The emulsification or homogenization of the fat and any of the solid or insoluble constituents entering into the composition of the food.
4. The pasteurization or sterilization of the food after it has been made.

Concerning the Utilization of Inositol in the Animal Organism. The Effect of Inositol upon the Metabolism of Man: R. J. ANDERSON AND A. W. BOSWORTH.

A study of the channels of elimination and the influence of inositol upon the metabolism of man. It is shown that in man inositol is eliminated only through the kidneys. About 91 per cent. of the ingested inositol disappears and only some 9 per cent. is excreted in the urine. When inositol is given at the rate of 0.5 grams per kilo of body weight it causes some diarrhea, but aside from this no other disturbance was observed; and with the exception of an increased excretion of creatinine it had no marked influence upon the metabolism of man.

Concerning the Utilization of Inositol in the Animal Organism in the Dog: R. J. ANDERSON.

These experiments were made with the object in view of throwing some light upon the fate of inositol in the animal organism and to determine whether inositol is utilized in such a way as to cause a rise in the respiratory quotient of a fasting dog.

The results show, first, that there was no rise in the respiratory quotient; second, that as much as 77 per cent. of the ingested inositol was recovered in the excreta, and third, that inositol is absorbed very slowly from the intestine of a dog and hence the greater portion is eliminated with the feces.

Studies on the Distribution of Nitrogen in Egg Lecithin: MARY LOUISE FOSTER.

The fact that the Herzig and Meyer method for determination of methyl groups gave inconclusive evidence of the presence of choline in lecithin has led the author to study the distribution of the nitrogen in lecithin. Merck's preparation of egg lecithin was purified and used for analysis. The methods employed were Kjeldahl with Arnold-Gunning modification for *total nitrogen*. Hausmann's method as modified by Osborne for the *anrich*, and *diamino nitrogen* and the Styli's method for *total amino nitrogen*. The results seem to indicate that the amide nitrogen represents less than 2 per cent. of the total, monoamino nitrogen about 40 per cent. and the diamino nitrogen about 50 per cent.

Further work is in progress.

Presence of Creatinine in Urine of Children: LOUISE STANLEY AND EMMA B. WAGNER.

We have planned a series of observations on the urine of children of various ages. In each case we obtained at least three samples for determination of creatine and creatinine in 100 c.c. of urine. We have tried in each to check this up by a twenty-four hour sample. The diets we were not able to control in all cases. We were, however,

able to get very accurate information in regard to them. We find that there is a very great irregularity of the proportion of creatine to creatinine. This variation is less in the case of babies on regular diet. It is quite as irregular on a creatine-free as on a creatine diet. In boys, it was present in the urine of a boy at ten while absent in his brother, aged twelve. Both were normal and active and on an ordinary mixed diet. In girls, it seems it may continue to puberty, where it appears intermittently in connection with the menstrual cycle. In some girls it disappears entirely before puberty. This phase we are at present investigating further. We hope to continue the investigation for several years and check further by determining the age at which it disappears from the urine of some of the children under observation. Our figures show that the diet plays an important function in the amount of creatine in the urine. It has been shown by other investigators that in starvation the feeding of carbohydrate decreases the amount of creatine in the urine. McCrudden has shown that increasing the carbohydrate in the diets of children causes not a decrease but if any change an increase in the creatine of urine. We have some evidence which tends to support this observation. This seems to us, however, to support the idea of a relationship between carbohydrates and creatine metabolism rather than the opposite which McCrudden is trying to prove. It seems quite possible that if the excretion of creatine is connected, as Rose suggests, with carbohydrate metabolism, you would expect a decrease on feeding carbohydrate in starvation. On the other hand, where there is a metabolic condition which results in a creatine excretion on a regular diet, this condition, if caused by carbohydrates, would be aggravated by the addition of more carbohydrate.

We have results which tend to support this theory and this will be the hypothesis upon which our future experiments will be planned.

A Bacteriological Study of Hamburger Steak: EDWIN LEFÈVRE.

In a study of hamburger steak, as sold in the public markets, the author, following the suggestions of Weingirl and Newton, worked out a technique which seems to afford the most satisfactory method for the bacteriological examination of chopped meat. The essential feature of the method is the careful selection of ten grams of lean meat from a pound of the product, this being ground up in a mortar with the aid of white sand and a 0.5 per cent. solution being added with continued grinding to secure the proper dilution for

plating. Beef infusion agar at $+1.5$ to be used in making counts.

Two series of samples from ten dealers were examined. In the first series collected in mild weather, *six* samples gave total counts of over ten million per gram. In the second series collected during colder weather *five* samples gave counts of over ten million. Meat from three dealers showed exceedingly high counts in both series, indicating that bad methods were followed.

The chief cause for high counts is to be found in the practise of utilizing scrap meat or meat of inferior quality which is often collected and held for some time before being ground up for sale.

Attention is called to the value of bacteriological analyses as a means of determining the methods used by dealers and to the importance of this test being more generally resorted to in connection with chopped meats for the purpose of establishing proper standards and securing an efficient sanitary control.

Cleaning Silver by Contact with Aluminium in Alkaline Solution: H. L. LANG AND C. F. WALTON, JR.

This paper is a preliminary report of results obtained in cleaning silver under household conditions by the electrolytic method. Sodium carbonate was found to be slightly more efficient than the bicarbonate as the electrolyte of the method, one teaspoonful of each washing soda and table salt to the quart of water proving the most economical concentration. The best results were obtained when the cleaning solution was kept at the boiling temperature during the cleaning, and aluminium proved more efficient than zinc as the active metal in contact with the silver.

The principal advantage of the electrolytic method, as compared with cleaning by an abrasive polish, is that it saves labor. In addition it is convenient and clean, and removes the tarnish from both sterling and plated silverware without appreciable loss of the metal.

Iron Rust Stains and Their Removal: New Methods: HAROLD L. LANG AND ANNA H. WHITTELEY.

In an experimental study of the removal of stains from textiles several new or little-known reagents were found successful for the treatment of iron rust spots. A 15 per cent. solution of titanium trichloride, $TiCl_3$, applied cold to the stain was found to be very efficient, although an expensive reagent. Iron rust stains could also be removed by boiling for several minutes in solutions of potassium acid tartrate (cream of tartar),

tartaric acid or citric acid, or in an infusion of the stalks, leaves or fruit of certain plants which contain oxalic or other acids. Among these plants are rhubarb, the begonia (a rather common house plant), the pineapple, and the grapefruit. These reagents have the advantage that they may be readily obtained and are less liable to injure the fabric or its color than are hydrochloric and oxalic acids, whose efficiency are well known.

Solutions of Lead and Antimony from Enameled Cooking Utensils: ELIZABETH W. MILLER.

Fifteen different makes of enameled dishes were boiled with 4 per cent. acetic acid and the solution tested for lead and antimony. Slightly less than 2 mg. of lead per liter were dissolved from the saucepan of standard make. Three others of the same kind gave mere traces.

Antimony was extracted by acetic acid in considerable amount from one cheap gray dish. Grape juice, cider and cranberry pulp, milk and spinach were cooked in dishes of this same make. All these foods contained antimony in amounts ranging from 2.3 mg. in 200 c.c. of milk to 14 mg. in 200 c.c. of cranberry pulp.

History and Present Methods of Fluorspar Production in Illinois: CARL C. LUEDEKING.

The author after giving a short history of the mining and milling methods of fluorspar in Pope and Hardin counties, Illinois, enters into the details of present-day status in this industry. It appears that four fifths of the fluorspar of the United States comes from the Fairview and Rosi Clare mines of Hardin County, Illinois. In 1914 these mines have produced 70,000 of the 78,000 tons of fluorspar used in this country. In 1915 the production increased to 115,000 tons. The fluorspar is used chiefly in the basic open hearth steel furnaces and for enameling.

The Chemistry and Technology of Glass: ALEXANDER SILVERMAN.

After a brief introduction on the history of glass making, followed by a statement concerning raw materials, their functions and uses, the technology of glass making was illustrated by about sixty lantern slides. A discussion of coloring and decolorizing agents followed and parallels were shown between aqueous and vitreous solutions of gold, compounds of uranium, copper, cobalt, aluminium, chromium, etc. Specimens of glass and related aqueous solutions were exhibited to illustrate the points discussed. Data on the treatment of glass included recent developments in etching, polishing and silvering processes. The importance of careful and comprehensive research in this

branch of industrial chemistry, and the necessity for endowment of such research, were emphasized.

New Volumetric Determination of Nickel and Cobalt: W. D. ENGLE AND R. G. GUSTAVSON.

Preliminary Report—Deposition of Copper in Electrotyping Baths: W. BLUM, H. D. HOLLER, H. RAWDON AND E. L. LASIER.

From a study of the microstructure and physical properties of copper, deposited upon graphited wax molds in the copper sulphate-sulphuric acid bath, the effects of the composition and temperature of the electrolyte and of the current density, upon the character of the deposits, have been determined. The conditions for the production of satisfactory electrotype shells have been defined. The relations between microstructure and physical properties, and the effect of annealing, are being investigated.

Let's Abolish Our Unnecessary Waste of Potassium Compounds: JAMES K. WITTHROW.

Attention is called to the fact that in case of sudden cessation of imports great hardship is done not only to chemical users of potassium compounds but many manufacturers of miscellaneous materials who are not in the category of chemical manufacturing and who do not have chemical advice to assist them in meeting the emergency on which they are thrown. A strong appeal is made for publicity in eliminating all unnecessary use of potash so that hardship will be avoided in such cases, and to give manufacturers of sodium compounds ample opportunity to build up their supply under non-emergency conditions. All of this, so that in case of great national emergency, we may direct our attention as much as possible to other situations which can not be avoided by any previous arrangement. Attention is called to the fact that in our schools and colleges our chemical texts persistently require the use of potassium compounds where experience has shown that sodium compounds would do just as well. If we can eliminate this and similar unnecessary waste the percentage saving may not be so great but the educational value can not be estimated for it is quite common for enormous amounts of potash to be wasted in ordinary manufacturing and everyday life as well as in chemical operations.

Experiments on the Corrosion of Iron and Steel: W. D. RICHARDSON.

Ethyl Alcohol from Wood Waste. IV. Yields from Various Species of Wood: F. K. KRESSMANN.

A Note on "Tars" from Some Mid-western Cannel Coals: JOHN C. INGRAM.

Cannel coals from Missouri and Illinois were distilled at 800° C. in iron retorts and the "oil" or "tar" collected. Yields of water-free tar varied from 30 to 50 gallons per ton. A typical sample (gravity 0.906) gave on distillation the following fractions:

To 150° C.	12 per cent.	Gravity 0.752
150°–200°	6 per cent.	" 0.788
200°–240°	9 per cent.	" 0.820
240°–270°	8 per cent.	" 0.880
270°–300°	16 per cent.	" 0.912
300° to coke	35 per cent.	" 0.945

The tars are largely made up of paraffin hydrocarbons, but seem to contain about 7 to 8 per cent. of tar acids. On standing these tars separate into two layers, the lower layer is semi-solid and shows a partial segregation of heavy paraffines. On centrifuging, four distinct products are obtained.

	Gravity
(1) In bottom . . . tar (mainly aromatics)	1.02–1.06
(2) 1st liquid	water
(3) 2d liquid heavy, viscous liquid	.96–.98
(4) 3d liquid	light oil .79–.85

Comments on the Krebitz Process of Soapmaking and Glycerol Recovery: G. A. WRISLEY.

After double decomposition of the lime soap with soda ash, the soap is salted out and the lime CaCO_3 allowed to settle. It was impossible to prevent occlusion of 10 to 20 per cent. of soap. Attempts to wash out the soap by a series of washings and filtration were unsuccessful, because of slow filtering and loss of 5 to 10 per cent. of soap in the lime cake. It was found that on adding water to this mixture with thorough agitation a point was reached where the lime sludge settled out occluding only 3 to 5 per cent. of soap. This mixture was filtered easily and less than 1 per cent. of soap was lost in the lime cake.

An Unusual Explosion in Connection with Potassium Chlorate: F. E. ROWLAND.

Laboratory Control in the Manufacture of Corn Syrup: A. P. BRYANT.

Effect of Aging upon the Constants of Chinese Wood Oil: D. F. McFARLAND AND H. R. LEE.

Effect of Fillers in Synthetic Molding Compounds: L. V. REDMAN, A. J. WEITH AND F. P. BROCK.

Printing Plates from Phenol Resins: L. V. REDMAN, A. J. WEITH AND F. P. BROCK.

The Effects of Moisture Introduced into the Digester in the Cooking of Soda Pulp: SIDNEY D. WELLS.

(To be continued)

CHARLES L. PARSONS
Secretary